

No new matter is introduced by the above amendments, therefore Applicants request their entry.

REMARKS

Claims 1-30 were originally pending in the application. After cancellation of claim 2, entry of new claim 31, and entry of the above amendments, claims 1, 3-31 will be pending in the application.

A. Response to Restriction Requirement

Applicants acknowledge the provisional election, with traverse, of Group I, *i.e.* claims 1-18 and 22-30, by the undersigned in a telephone call on October 17, 2001.

Applicants assume a typographical error has occurred in the Office Action with respect to Group II, which is drawn to articles having structural limitations, in that claim 22, drawn to a process for preparing a nanocomposite, is clearly not a part of Group II.

While Applicants do not contest the distinctness of Groups I and II, in addressing the question of distinctness, the Office Action characterized the claims of Group II as being drawn to a “process of use” for the compositions of Group I. Characterizing the articles of Group II as a “process of use” is incorrect and improper.

Applicants request that the restriction requirement be reconsidered because the Examiner has not shown that a serious burden would be required to examine all the claims. M.P.E.P § 803 provides:

If the search and examination of an application can be made without serious burden, the Examiner **must** examine it on the merits, even though it includes claims to distinct or independent inventions.
(*Emphasis added.*)

Thus, for a restriction to be proper, the Examiner must satisfy the following two criteria:
(1) the existence of independent and distinct inventions (35 U.S.C. § 121); and (2) that the search

and examination of the entire application cannot be made without serious burden. *See* M.P.E.P § 803.

The Office Action has not shown that the **second** requirement has been met. Specifically, the Examiner has not shown that it would be a serious burden to search and examine all of the groups together. A search relating to the compositions of Group I would significantly overlap with the search required for the multiplayer articles of Group II, and the examiner has not shown that an undue burden would be produced by the combined search. Consequently, reconsideration and modification or withdrawal of the restriction is requested.

B. Claim Rejections for Indefiniteness Under 35 U.S.C. §112

Claims 2-4, 7, 8, 13, 20, and 21 are rejected under 35 USC 112(2) as allegedly being indefinite with respect to the Markush language. Applicants first point out that claim 20 was not provisionally elected under the restriction requirement, and is not currently under examination.

Applicants decline to amend rejected claims 2-4, 7, 8, 13, and 21 to recite the Markush language cited by MPEP 2173.05(h)(I), *i.e.*, by deleting Applicant's original "comprising.... or....," language and inserting therefore the Markush language "selected from the group consisting of ...and....", as suggested by the Office Action. The rejected claims do not recite improper Markush language, as discussed in MPEP 2173.05(h)(I). On the contrary, the language of current claims 2-5, 9-11, 15-18 and 20-22 is acceptable "OR TERMINOLOGY," as described in MPEP 2173.05(h)(II). Applicants assert that the "OR TERMINOLOGY" is clear and unambiguous.

Applicants believe that the rejections stated in the Office Action are in response to Applicants use of the word 'comprising,' because MPEP 2173.05(h)(I) cites *Ex Parte Dotter* (12 U.S.P.Q. 382 (Bd. App. 1931) for the proposition that "It is improper to use the term "comprising" instead of "consisting of," at least in the context of Markush groups. Applicants note that in *Ex Parte Dotter* a closed claim construction (*i.e.* 'consisting of' rather than an open

construction employing ‘comprising’) was required for patentability over the prior art¹. In contrast, Applicants rejected claims do not require a closed construction for patentability over the prior art. Applicants intend that the recited dependant claims retain an open construction, which requires the presence of one of the cited alternative components, but does not exclude other components. Applicants’ intent was to achieve an open construction, by use of the term ‘comprising,’ in combination with acceptable “OR TERMINOLOGY.”

Additionally, Applicants note that MPEP 2173.05(h)(I) notes that its preferred Markush language is merely “One acceptable form of alternative expression.” MPEP does not explicitly reject Applicants’ “comprising”...or...” language.

Lastly, Applicants assert that insertion of the Markush language of MPEP 2173.05(h)(I), as advocated by the Office Action would unnecessarily limit the claims. The use of “consisting of” language, as advocated by the Office Action might be interpreted as implying an unintended closed construction, and a narrowing of the claim, subjecting the amended claims to an unintended and unnecessary estoppel effect. See *Festo Corporation v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 234 F.3d 558, 56 U.S.P.Q.2d 1865 (Fed Cir. 2000).

The amendments and arguments presented above are fully responsive to, and overcome all the rejections alleged by the Office Action under 35 U.S.C. §112, second paragraph, and therefore those rejections should be withdrawn.

C. Rejections Under 35 U.S.C. §102

Claims 1-2, 5-8, 10-12, and 14-17 are rejected under 35 U.S.C. § 102 (b) as allegedly being anticipated by Pinnavaia (U.S. Pat. No. 6,017,632). The Office Action asserts that

¹ A copy of *Ex Parte Dotter* is enclosed. The issue was whether claim 17, which specified “a mass of loose granules of a natural material of the group comprising wood and grains,” was anticipated by the Levy reference, which disclosed the use of “cotton-wool or cellulose wadding.” The Board remarked; “The word ‘comprising’ does not exclude other materials besides wood and grains. It is considered that the word ‘consisting’ would be more appropriate in this relation in confining the material strictly to those materials – wood and grains. If this formal change is made in claim 17, it may be allowed.” Thus, in *Ex Parte Dotter*, the holding was that on the specific facts of that case, a “formal” amendment to implement a closed “consisting of” Markush claim was required for patentability over the disclosures of the Levy reference. Nothing in *Ex Parte Dotter* supports a proposition that open “comprising” claim terminology is unacceptable in a Markush group if the open language avoids the prior art. Thus, there is no basis in *Ex Parte Dotter* for the proposition stated in MPEP 2173.05(h)(I), and in the Office Actions, that

Examples E2 – E6 of Pinnavaia teach the preparation of purified clays and epoxy nanocomposites derived therefrom that “inherently” meet Applicants’ claim limitations regarding “less than 2% quartz.”

Pinnavaia focuses on the intercalation of clays (in the acid form) with certain electrically neutral, organic, and basic “curing” agents, and the combination of those intercalated clays with the monomeric precursors of certain polymers, to produce certain “cured” polymer nanocomposites, such as epoxy nanocomposites. See for example, Figure 1, and Column 1, lines 11-18. Pinnavaia’s examples E2-E6 relate to the preparation of such “cured” epoxy nanocomposites. Example E2 (and examples E3 and E4 by reference) merely mention in passing that “Na⁺ Montmorillonite was purified by sedimentation to remove quartz and other dense, large grain contaminants.” Nowhere do examples E2-E6, or the rest of Pinnavaia, address whether any particular small particle size or concentration of quartz might be acceptable. In contrast, Applicant’s claim 1 recites a specific weight percentage (less than about 2 % by weight) of a particular contaminant (quartz) regardless of the particle size of the quartz particles.

Inherent anticipation occurs when “the prior art necessarily functions in accordance with, or includes the claimed limitations.” *Atlas Powder Co. v. Ireco Inc.*, 190 F.3d 1342, 1347 (Fed. Cir. 1999). “Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *Continental Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 578, 581, 20 U.S.P.Q.2d 1746,1749 (Fed. Cir. 1991). The weight % of quartz present in Pinnavaia’ purified clay samples would depend on many variables. Nothing in a teaching of “sedimentation to remove quartz and other dense, large grain contaminants” would necessarily produce a clay having less than about 2 % by weight of quartz. For the purposes of anticipation, missing elements may not be supplied by the knowledge of one of skill in the art. See *Structural Rubber Prods. Co. v. Park Rubber Co.*, 749, F.2d 707, 716, 223 U.S.P.Q. 1264, 1271 (Fed. Cir. 1984).

The Office Action also asserts that nanocomposite properties such as improved haze and permeability, “will be inherent properties of the thermoplastic composition of the prior art.” The

“It is improper to use the term “comprising” instead of “consisting of.”

assertion is technically oversimplified and legally insufficient. Many factors contribute to the overall degree of haze observed in an article comprising a given nanocomposite, including platelet-particle agglomeration, the degree of crystallinity of the polymer resin employed, surface inhomogeneities, and the processing conditions employed to make the nanocomposite and/or article. As taught by Applicants on page 1, line 21 through page 2 line 2, many nanocomposites exhibit levels of haze that are unacceptable for blow molding articles such as beverage bottles. Thus there is no certainty, or even reasonable inference, that Pinnavaia's nanocomposites of examples E2-E6 had low haze. Therefore low haze was not "inherent" in Pinnavaia's epoxy nanocomposites. Therefore, Pinnavaia does not anticipate Applicants' claims, "inherently" or otherwise.

Neither does Pinnavaia make Applicants' claim 1 obvious. Nothing in Pinnavaia teaches or suggests the production of a clay having less than about 2 % by weight of quartz. Moreover, Applicants have amended claim 1 to recite a "melt-processible matrix polyamide." Pinnavaia's claim 16 discloses polyimides, not polyamides. Pinnavaia major emphasis is on clays intercalated with neutral organic "curing agents" as applied to a wide variety of "cured" thermoset polymers, such as polyurethanes, polyureas, polysiloxanes, and alkyds (see column 10, lines 23-36). Pinnavaia also discloses (column 11, lines 1-12) that the clays intercalated with his curing agents could be combined with "all" thermoplastics, including thermoplastic versions of the epoxies and other polymers cited above, as well as an additional list of 19 additional classes of thermoplastic polymers, which include, as a single subgenus from the list, "polyamides."

An assertion that Pinnavaia renders obvious Applicants' amended claim 1 would require motivation for one of ordinary skill in the art to select, from the whole disclosure of Pinnavaia, (1) the abbreviated teachings of Examples E2 and/or E3 regarding the use of purified clays, (2) the inference of a limitation to "less than 2% quartz," and (3) the modification of the epoxy polymers taught in examples E3-E6 by yet another selection (from the many classes of polymers disclosed in the specification), of a particular subgenus of "uncured" thermoplastic polyamide polymers. To produce a *prima facie* rejection for obviousness, there would need to be motivation or suggestion for each of these selections and/or modifications. See *Yamanouchi*

Pharmaceutical v. Danbury Pharmaceutical, 231 F.3d 1339, 1343-1345, 56 U.S.P.Q.2d 1649 (Fed Cir. 2000). There is no sufficiently specific teaching, suggestion and/or motivation in Pinnavaia for such a series of modifications and/or selections, and hence no prima facie basis for rejecting the amended claims for obviousness over Pinnavaia.

The Office Action points to Pinnavaia's examples E3 and E5 as disclosing the use of NH_4^+ or $\text{C}_{18}\text{H}_{37}\text{NH}_3^+$ cations to intercalate layered clays, presumably with reference to certain of Applicants' dependent claims. In Example E3, the NH_4^+ cation is merely employed as an intermediate for purifying the clay, and is intentionally thermally decomposed to regenerate the clay in a purified and ammonia-free acidic form, and no nanocomposite is produced from a clay intercalated with NH_4^+ . Example E5 mentions the use of epoxy nanocomposite clays intercalated with $\text{C}_{18}\text{H}_{37}\text{NH}_3^+$ cations in a comparative sense, and teaches away from their use, because they "decreased the effectiveness of the clay reinforcement" in the epoxy nanocomposite. See also the teaching away from such alkyl ammonium ion intercalated clays at column 4 line 56 through column 5 line 7. Therefore, neither the NH_4^+ intercalated clay of example E3, nor the epoxy nanocomposite of example E5 obviate Applicants dependent claims reciting organic cations (claims 8 and 11-13).

Therefore, Applicants' amended claims are neither anticipated by, or obvious over Pinnavaia.

D. Rejections Under 35 U.S.C. §103

Obviousness Rejections Over Pinnavaia In View of Clarey

Claims 1-2, 5-8, 10-12, and 14-17 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Pinnavaia in view of Clarey (U.S. 6,050,509). Clarey is cited for its disclosure of processes for purifying clays intended for use in nanocomposites, and its teachings of levels of total impurities of less than 2 weight percent.

First, Clarey provides no teachings or guidance at all about what polymers (polyamide or otherwise), should be selected to prepare the nanocomposites, so as to obtain the benefits of the disclosed clay purification. Thus, even if, *arguendo*, Pinnavaia and Clarey are properly

combinable (which they are not, see discussion below), Clarey does not provide a teaching, suggestion, or other basis to modify the epoxy nanocomposites of Pinnavaia's Examples E2-E6 so as to incorporate thermoplastic polyamide polymers, rather than cured epoxies, for the preparation of nanocomposites. Thus Clarey does not remedy the failure of Pinnavaia to teach or suggest a basis for selecting polyamide polymers.

As to motivation for the combination of Pinnavaia and Clarey, the Office Action states "Impurities in a natural clay result in discoloration and haze and it may impair properties such as gas permeability of the composition (col 1, lines 40-47)," so that it would be obvious "that the product obtained would have a clear, transparent appearance and good gas permeability." These statements contain hindsight-based embellishment of Clarey's actual teachings.

Clarey teaches (at column 1, lines 29-33) that "exfoliated platelets" may increase strength, temperature resistance, gas impermeability, and other properties. Clarey mentions (at column 1, lines 39-42) that clay impurities "caused a decrease in the properties that the platelets are designed to increase." Nevertheless, nowhere does Clarey specifically teach or suggest that quartz impurities degrade "haze," "discoloration," "transparency," or "clarity," or that the removal of quartz would improve those properties, or even gas permeability. Therefore, the motivation to combine Pinnavaia with Clarey recited by the Office Action does not have a proper evidentiary basis, and is not sufficiently specific to motivate one of ordinary skill in the art to remove quartz to less than 2%. Clearly, the specific limitations regarding the gas permeability and/or haze of "article" claims 16-17 and 28-30 are not disclosed in either Pinnavaia or Clarey. Moreover, nothing actually taught or suggested by either of Pinnavaia or Clarey suggests Applicants unexpectedly superior results pertaining to improvements in haze, discoloration, transparency, and clarity, as disclosed, inter alia, on Applicants' pages 1-3, 30-31, and in the examples and Table 2. Therefore, Applicants' amended claims are not obvious over Pinnavaia in view of Clarey.

Obviousness Rejections Over Pinnavaia and Clarey In View of Beal

Claims 1-2, 5-8, 10-12, and 14-17, and claims 3-4, 13, 18, and 22-30 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over Pinnavaia and/or Clarey, in view of Beal (U.S. Patent No. 5,552,469). Beal is cited for its disclosure of particular polyamides, such as poly(xylylenene adipamide), and for processes for preparing nanocomposites that employ polymers or oligomers to intercalate the clays.

Beal discloses, in columns 9-17, a huge listing of polymers and/or oligomers that might be employed to prepare the nanocomposites of his invention. As disclosed in columns 9-13, water soluble polymers or oligomers (preferred examples include polyvinylpyrrolidone, poly(vinyl alcohol) and polyacrylic acids) are used to initially intercalate and expand the clays. Then the clays that have been intercalated with water soluble polymers and/or oligomers are exfoliated and dispersed into thermoplastic and/or thermosetting matrix polymers, as disclosed in columns 13-17. Beal mentions that polyamides are suitable matrix polymers for his invention, and also mentions poly(m-xylylene adipamide. See column 14, lines 9-15 and column 16, lines 17-18.

Nevertheless, merely identifying the individual elements of Applicants' claims in one or the other reference is legally insufficient to establish a *prima facie* case of obviousness. It is the burden of the Office to show that the prior art, when considered as a whole, teaches or suggests Applicants' claims as a whole. "There must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant." *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d, 1313, 1316 (Fed Cir. 2000) (underlining added). There must be suggestion or motivation for each selection and/or combination. See *Yamanouchi Pharmaceutical v. Danbury Pharmaceutical* at 1343-1345. The suggestion or motivation asserted must also be supported by objective evidence. See *In re Dembiczak*, 175 F.3d 994, 999 (Fed Cir. 1999). The prior art must also provide a reasonable expectation of success for the proposed combination. See *In re Dow Chem. Co.*, 837 F.2d 469, 473, 5 U.S.P.Q.2d 1529 (Fed Cir. 1988).

Applicants reiterate their earlier denials there is motivation to combine Pinnavaia and Clarey. The Office Action recites a number of the technical features of Applicants' claims allegedly taught in Beal, but fails to identify and properly support with objective evidence a motivation to select and combine the specific combination of the elements of Applicants various claims from among the teachings of either Beal or the other two references. For example, there is no recitation of a sufficient motivation to select polyamides (or polyxylylene adipamide) from the large number of polymers recited in Beal, and then combine them with the needed selection of the individual features of Pinnavaia and Clarey, so as to produce the specific combinations of elements of claims 1, 4, or 13. There is similar lack of motivation to select and combine the oligomers of Beal and combine them with the relevant features of Pinnavaia and Clarey, so as to produce the combination of elements of independent claim 22. With respect to Applicants' claims that require treatment of the clay with an organic cation (claims 8 and 11-13), any such proposed combination would neglect the teachings of Pinnavaia that such cations are undesirable and of Beal that they are unnecessary, which are relevant to the legal requirement of a reasonable probability of success for the proposed combinations. Therefore, the Office Action fails to state a prima facie case to reject Applicants' claims for obviousness over Pinnavaia and Clarey in view of Beal.

Rejections Over Pinnavaia, Clarey, and Beal in View of Maxfield

Claims 1-8, 10-18, and 22-30, and claim 9 were rejected under 35 USC 103(a) as allegedly being obvious over Pinnavaia, Clarey, and/or Beal, in view of Maxfield (WO 94/11430). Maxfield is cited for its teachings of silicate particle sizes, and the use of nanocomposites in food packaging or bottles, which may have excellent gas barrier properties.

The Office Action again recites a number of the features of Applicants' claims that are allegedly taught in Maxfield. However, as stated earlier, the mere identification of the various technical features of the claims in one or more references does not provide legally sufficient motivation to select the specific combination of the features of claim 9 from the four references. The Office Action did not specifically identify and support with objective evidence a legally

sufficient motivation to combine and select the specific combination of the features of claim 9. The Office Action therefore fails to state a valid *prima facie* case to reject claim 9 or the other claims for obviousness.

Unexpectedly Superior Results

Above and beyond the fact that there is no *prima facie* case of obviousness, Applicants have made a sufficient showing of unexpected and superior results so as to overcome a *prima facie* rejection for obviousness. On page 13, lines 6-22, and page 30, line 23 through page 31, line 26, Applicants teach that polyamides and/or poly(m-xylylene adipamide) have processability, and/or physical characteristics that make them particularly suitable for applications in nanocomposites for the preparation of articles, including articles comprising multilayer structures. The unexpectedly superior properties of articles comprising Applicant's claimed nanocomposites, especially in oxygen and/or gas sensitive food packaging applications are important to long felt but unsatisfied needs for plastic articles such as bottles, especially plastic beer bottles, wherein clarity of the bottle and oxygen induced spoilage remains a currently unsatisfied problem. Moreover, Applicants' examples, especially examples 1 & 3, illustrate the unexpectedly superior gas barrier properties of films comprising Applicants' claimed nanocomposites. In the multi-layer articles, unexpectedly superior haze levels are also obtained in applications where high transparency is required. Therefore, Applicants showing of unexpectedly superior results overcomes any *prima facie* case of obviousness based on the cited references, and additionally and separately establishes the non-obviousness of Applicants' claims.

CONCLUSION

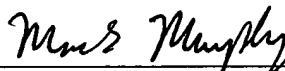
Pursuant to the above remarks, all the rejections stated in the Office Action have been overcome, and reconsideration and allowance of the pending application is believed to be warranted. The Examiner is invited and encouraged to directly contact the undersigned if such contact may enhance the efficient prosecution of the application to issue.

ATTORNEY DOCKET NO.: 05015.0302
SERIAL NO. 09/583,120

Enclosed is a Supplemental Information Disclosure Statement filed under 37 C.F.R. §1.97(c), as well as the Form PTO-1449 and copies of the five references associated therewith. A copy of *Ex Parte Dotter* is also enclosed. No fees are believed due. However, the Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Very truly yours,

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I hereby certify that this correspondence and any documents referenced herein as being enclosed herein are being deposited with the United States Postal Service as Express Mail Invoice No. EL055858867US in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on the dated listed below.


Sean Cruz

Date 1/30/02

APPENDIX A

Marked-Up Copy of Amended Claims 1, 3-4, 8, 13, 22, 24, and 30

1. (Once Amended) A polymer-clay nanocomposite comprising:
 - (iii) a melt-processible matrix [polymer]polyamide, and incorporated therein
 - (iv) a layered clay material having less than about 2.0 % by weight of quartz, based on the weight of the clay material.
3. (Once Amended) The nanocomposite of claim 1, wherein the melt-processible matrix [polymer]polyamide comprises a partially aromatic polyamide, aliphatic polyamide, wholly aromatic polyamide or a mixture thereof.
4. (Once Amended) The nanocomposite of claim 1, wherein the melt-processible matrix [polymer]polyamide comprises poly(*m*-xylylene adipamide) or a copolymer thereof, isophthalic acid-modified poly(*m*-xylylene adipamide), nylon-6, nylon-6,6, [or]a copolymer thereof, [EVOH] or a mixture thereof.
8. (Once Amended) The nanocomposite of claim 1, wherein the clay material comprises sodium montmorillonite or sodium bentonite that has been treated with an organic cation.
13. (Once Amended) The nanocomposite of claim 1, wherein the melt-processible matrix polymer comprises poly(*m*-xylylene adipamide) or a copolymer thereof, and the clay material comprises sodium montmorillonite or sodium bentonite that has been treated with an organic cation.
22. (Once Amended) A process for preparing a polymer-clay nanocomposite comprising the steps of:

- (i) forming a concentrate comprising an oligomeric resin and a layered clay material having less than about 2.0 % by weight of quartz, based on the weight of the clay material, and
 - (ii) melt mixing the concentrate with a melt-processible matrix [polymer]polyamide to form a polymer-clay nanocomposite.
24. (Once Amended) The process of claim 22, wherein the oligomeric resin and the melt-processible matrix [polymer]polyamide have the same monomer unit.
30. (Once Amended) A process for reducing haze in an article having a nanocomposite material comprising:
- (i) preparing a polymer-clay nanocomposite material comprising the step of mixing a melt-processible matrix [polymer]polyamide and a layered clay material having less than about 2.0 % by weight of quartz, based on the weight of the clay material, to form a polymer-clay nanocomposite material; and
 - (ii) molding an article from the nanocomposite material, wherein the article has a haze which is at least about 4 percent lower than that of an article formed from a nanocomposite having unpurified clay therein.